Sensitivity of loan size to lending rates: Evidence from Ghana's microfinance sector

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ABSTRACT

Recent evidence from the microfinance industry reveals increases in sources of funding which anecdotally links to the profits of institutions. This phenomenon has evoked concerns for the responsiveness of the poor to credit market operational policies such as loan pricing. This paper integrates the poor's characteristics into a loan size equation to estimate influence on interest rate stimulus. Using data from Ghana, we test the hypothesis of loan price inelasticity using quantile regression and the interaction procedure. The quantile regression shows pronounced variations in responsiveness of loan size to interest rate changes at different percentiles. In contrast to an inverse relationship depicted between the 20th and 40th quantiles, we observe positive and fairly flat curvatures at the extremes and around the median. Motivated by this finding, the interaction procedure is employed for household poverty scores and lending rates at varied statistic to identify differences in clients' responsiveness. The semi-elasticity of loan amount responsiveness to a unit change in interest rate is more than proportionate and significant for the poorest group. In a broader context, the need for market segmentation based on socio-economic well-being is suggested in the paper in pursuance of the 'win-win' objective of poverty reduction and financial sustainability.

Key Words: Interest rate, sensitivity, loan size, poor, microfinance and Ghana.

JEL Codes: G20, G29 and I30

1. Introduction

One of the provocative questions in the microfinance sector is on its relatively high interest rates. Although, the studies have revealed wide interest rate variation of at least 50 per cent between formal financial institutions and moneylenders, (Armendariz de Aghion, and Morduch, 2005) . the spatial and other institutional differences in interest rates have led to sustained concern on the price of loan in the microfinance sector. Rosenberg et al. (2009) estimates an average interest rate yield of 30 per cent and conclude that microfinance lending rates are not usurious. However, country specific high interest rates of 80 per cent annum evidenced in Mexico and South Africa engender concerns on who is paying what, effect on average returns and client's responsiveness. In a related argument, Paranjape (2008) questions microfinance institutions' interest rate rigidity in an era of low and changing lending rates. In this paper, we propose an approach in determining levels of lending rates is an assessment of clients' loan size sensitivity to interest rate changes given their socio-economic status.

The drift from subsidized credit to commercial borrowing, mostly by the famous Mckinnion and Shaw hypothesis[1], demands a response on how the poor borrower's average returns is affected. However, identifying the impact of subsidy removal via returns on borrowing rather than repayment offers a better understanding of the poor's coping strategy and effect on economic activity after repayment. In this paper, we argue from hindsight that borrowers' poor status moderates the relationship between interest rate and amount of loan take-up. The paper hypothesize that clients at the margins of socio-economic status are sensitive relative to the majority in the middle band which is premised on the positive externality of group mechanisms in minimizing information asymmetry amongst the extreme poor. The policy thrust of the paper is to explore the much-advocated need for market segmentation in microfinance with greater emphasis on clients' socio-economics status.

Until recently, , microfinance operations are heavily based on client insensitivity. The evidence of subsidies distorting microfinance operations and the honesty and capability of the poor in repaying loans underpins the 'win-win' rhetoric of microfinance (Morduch, 2000). There is a higher degree of mismatch between high demand for financial services and inadequate number of financial service delivery outlets (Arun and Hulme, 2003) Pricing of loan amount in microfinance is similar to the practice of financial institutions that has principally relied on the cost of funds, transaction cost and the mark-up. However, there are two issues which make a distinct difference in microfinance. The first tries to disentangle the role of subsidies that is very much present in microfinance operations. Microfinance practitioners aware of the effect of subsidies have either discounted subsidies at the outset or mitigate its effect through an exit approach over time. Either of these approaches is not a familiar practice in traditional banking and evidence of its adverse consequences in the microfinance market abound (Morduch,

[1] The fundamental tenet of the Mckinnon and Shaw hypothesis asserts that thorough liberalization of financial markets overcomes repression arising from interventions such as provision of cheap external finance and imposition of tariffs. "Artificially low-cost loans or subsidized credit programs may be both unnecessary and unwise" (Mckinnon, 1973; pp. 15).

1999). The second feature of microfinance market deals with the high and differential transaction cost of the poor. High cost from the perspective of the poor's characteristics and differential due to the operational mechanisms. The latter includes the use of social collateral to delegate screening, monitoring and enforcement of repayment in contrast to asset-based collateral. These differences constrain the adaptability of mainstream theoretical argument on interest rate and borrowing.

Central to Stiglitz and Weiss (1981) arguments on demand for credit, rationing and outcomes are the issues of information asymmetry, interest rate and collateral. . The two outcomes of this work - attracting risky borrowers (adverse selection) and rationing stumble in the case of microfinance clients. Three reasons can be identified for this: First, microfinance clients' economic activities are mostly homogenous and the poor in general are risk averse. Secondly, the argument of client insensitivity if true weakens the expected link between interest rate and adverse selection. Thirdly, non-use of financial and physical asset-based collateral limits the options of microfinance lenders to enforce rationing.

The implausible connection between credit market theory and microfinance practice has led to mixed policy alternatives in gauging interest rates in different economies. This includes interest rate caps, market segmentation based on economic activity, government direct involvement in retail financing and so forth. Most of these interventions in the past decade have either failed or remains at the experimental phase. The dilemma on the nature of relationship and gradient between interest rate and loan size still remains unresolved with hard evidence. The obvious way forward is to revisit the validity of the assumptions characterizing the poor's perceived insensitivity to interest rate charges. This motivation has spurred on some empirical research on the subject matter in the immediate past years. Among these include; Dymski, (2003); Dehejia et al., (2005); Karlan et al., (2007); Briones, 2007 and Karlan and Zinman, (2008). An emerging consensus from these studies points to a demystification of the notion of client insensitivity. Very commendable, most of these studies are characterized by rigour econometric approaches. Econometric tools such as randomized experiments, fixed and random effects, instrumental variable estimation and heckman two-stage estimation are used to resolve potential problems of unobserved heterogeneity, endogeneity and sample selection. Conspicuously missing however is client socio-economic characteristics and how sensitivity varies across different categories of poor borrowers.

In this paper, we use quantile approach to justify the application of interaction procedure in least squares to estimate the poor's sensitivity to loan price. Empirical analysis relies on data from Ghana which consists of both clients and non-clients sample. We further explore the robustness of our estimates by addressing potential problems of endogeneity and sample selection using traditional second stage methods of instrumental variable and 'heckman' estimations. The contribution of this paper is the use of the entire sample to verify the poor's sensitivity in contrast to the use of sub-samples as offered in all recent papers cited earlier. The estimation procedure is done as follows: in the first stage we estimate a quantile regression of a basic loan size equation at different percentiles to assess variations in responsiveness for all covariates especially interest rate; second stage

employs the interaction procedure for household poverty scores and lending rates at varied statistic to identify differences in clients' responsiveness; finally we compare our results with sub-sample approach, test and correct for problems of endogeneity and sample selection.

In contrast to least squares estimation showing a less than unitary downward change in loan size for a small change in interest rate, we observe a pronounced gentle downward slope between the 20th and 40th quantiles. Coupled with this observation are the respective positive and relatively flat curves at the tails and between the 40th and 65th quantiles. Karlan and Zinman's (2008) inclination of the potential effect of poorer clients on the relationship between interest rate and loan size is empirically verified with a multiplicative interactive procedure. Subsequently, we show that the semi-elasticity of loan amount responsiveness to a unit change in interest rate is more than proportionate (2.4%) and significant with a statistic explaining the distribution of the poorest twenty percent. In a sharp contrast the coefficient of interest rate using the 50th percentile is price inelastic and insignificant.

The next section of the paper discusses the theoretical debates and some recent empirical findings on the determinants and levels of interest rate and client sensitivity. It draws on some of the main issues indebted to interest rate fixing and relates that to arguments for and against a market-driven competitive microfinance industry. Macro level factors such as prime rate and general macroeconomic environment are perceived as exogenous to the focus of this paper and therefore are not discussed. This section will be followed by a brief description of the microfinance industry in Ghana. Sections four and five discuss the methods of study and results respectively. The final section concludes and identifies two core policy issues emerging from the discussion and analysis.

2. Debates

The analysis of Mckinnon and Shaw hypothesis sets the tone for financial sector deregulation in most countries. Since then, interest rate determination in formal financial institutions has experienced a transition from various forms of direct regulation to a system deregulation. The latter permits the market through the demand and supply of loans to determine rates. The principal justification for the turnaround is the plausibility of financial repression in a regulated regime. Black et al. (1997) posits that denying financial service providers the opportunity to charge interest rates at the market equilibrium leads to spiral shortages as potential lenders are sidelined due to government direct involvement in retail financing. Thus regulating interest rates through diverse means such as caps, high bank reserve and liquidity ratio requirements discourage innovation and diversification of loan products.

This view point although strongly upheld, Levine et al. (1999) identify broad financial functional roles of the state[2] to mitigate some lapses that emerge as a result of market determination of interest rate. Permitting credit markets to determine interest rate through the economic forces of demand and supply of loans leads to rationing as a result of imperfect information (Stiglitz and Weiss, 1981). Stiglitz and Weiss (1981) argue from

[2] This includes legal frameworks for contract enforcement and broad accounting and reporting standards.

the perspective of a pool of borrowers that react to interest rate and collateral set by banks. Riskiness of projects and attitude of borrowers constrains banks to continuously increase interest rates and collateral requirements even in the case of excess demand for loan. The obvious consequences of adverse selection and moral hazard stare in the face of banks. Overtime banks have developed other mechanisms to mitigate these potential problems. For instance during all three[3] principal phases of a loan life, non-asset based strategies[4] are employed to minimize loan default, fungibility and to stimulate and redirect investment to prioritized sectors of an economy.

With this backdrop of information on the state of play in traditional banking system an open question about the applicability of this theory and practice to microfinance market remains unanswered. The starting point for any discussion is to acknowledge that the market for microfinance is a residual of the traditional banking market. The philosophy underpinning the emergence of microfinance was to serve the neglected market niche of the traditional banking system. This market niche though hard to define, in practice has been labelled with different names. This includes the 'unbankable', poor, brave poor, economically active poor and so forth. A plausible reason for the different labelling overtime is the on-going identification of a group of clients capable of responding favourably to banking needs and services. Operational strategies of making loans to the poor adds to the difficulty of finding an 'ideal' group of clients that hitherto had been neglected by traditional banks but viewed as 'bankable' clients in microfinance. Practices such as group lending, joint liability, receipt of subsidies, grants and government direct intervention, small and frequent loan repayments, forced savings, maintenance of a minimum balance of savings throughout the loan life and incorporating other non-financial services complicates the adaptation of banking theory to suit microfinance. These issues directly or indirectly affect the core factors of determining interest rate, that is loan loss, transaction cost and mark-up. We discuss briefly in the following sub-sections issues mainly surrounding transaction cost as it is the main perceived driver of interest rate.

Efficiency and Interest Rate

Proponents of microfinance paradigm argue strongly on the capability to drive down interest rate by achieving efficiency via economies of scale. While this notion is consistent with basic economic literature, Rosenberg et al. (2009) reports that microfinance institutions benefit marginally beyond 2000 number of clients. In their viewpoint, economies of scale cannot do much to offset the added expense emerging from the dispensation of small loans and frequent servicing. Added to this, other factors including competition, lower transaction cost and subsidy are indispensable in trying to achieve efficiency. Porteous (2006) use the market development continuum framework[5] to assess price competition in three different microfinance markets in Bolivia,

[3] Screening, Monitoring and Enforcement.

[4] Among the non-asset based strategies include credit history, submission and assessment of business plans and their viability and other demographic and communal records.

[5] The market development continuum framework identifies four stages of development. Stages one and two describe the pioneering and take-off phases which is supply driven in terms of price determination. While stages three and four asserts the consolidation and maturity phases which offers price competition and other lower cost driving factors such as efficiency and technological innovation. This stage is primarily driven by consumers (demand).

Bangladesh and Uganda. An intriguing finding of Porteous' assessment is the possibility of microfinance markets to delay unduly price competition as observed in Bangladesh microfinance market. In contrast, the Bolivian microfinance market drove down interest rates through price competition at a very early stage of their market development, while the Ugandan market was observed to be entering the consolidation phase.

The aforementioned observations offer significant number of caveats that are worth considering in asserting plausibility of driving down interest rates through competition, lower transaction cost, subsidy, efficiency and scale. We assert in this paper that the success of these supply-side factors depends on the socio-economic characteristics of clients. Thus average return on economic activity is an important determinant of client's influence on the relationship between interest rate and loan take-up.

Transaction Cost

Pricing of microfinance services like any other good or service is a function of transaction cost. Transaction cost in the delivery of financial services, basically has three components; the cost of funds for on-lending, the cost of risk (loan loss) and administrative cost (processing loan applications, educating or training of clients and monitoring for loan repayment)[6]. The above makes it imperative to reach the conclusion that absolute transaction cost per head of the poor is more expensive than a client of a formal financial institution.

Received wisdom has long been that, lending to poor households is not worth it due to too high costs, too great risks, too low saving propensities and too few households capable of putting up collateral (Morduch, 1999). The likely consequences of these adverse characteristics have been dealt with through alternative mechanisms such as group lending and joint liability, forced savings and small and regular loans and repayment. These mechanisms seem to prove that microfinance can be sustainable. In spite of the ingenuity of delegated screening, monitoring and enforcement, transaction cost are up the roof and used as the main argument for high interest rates. Obvious reasons are the other strategies of microfinance operations including small amounts of loans and forced savings, remote settlements and provision of non-financial services. For instance, Rosenberg et al. (2009) asserts that the effect of compulsory savings increases the effective cost of the loan to the borrower.

In microfinance, cost components of animating groups, purchase of forms, implications of 'forced-savings' and frequent repayment rate constitutes the difference between real and effective interest rate. The precise magnitude of the difference is unknown but anecdotal evidence points to a more than 100 per cent gap. Less obvious, but added to this cost component is time spent and opportunity cost in servicing the loan. In the case of poor clients this is high due to the inclusion of non-financial services as loan beneficiaries spend more time with bank staff. Finally non-use of high technological devices such as computerized operations increases per unit cost.

[6] It is important to underscore the need non-quantifiable component of transactional cost normally emerging from the perspective of the borrower. This includes waiting time with or at bank premises, transportation cost and cost of delay in receiving loans.

Subsidies

Poverty reduction through subsidized credit was the centrepiece of development strategies of many countries from the early 1950s through to the 1980s. Available evidence suggests that the strategy failed for a number of reasons. This include low loan repayment rates which dropped to below 50 per cent in some cases, increased cost to donor and worsening government fiscal deficit and diversion of credit from intended recipients to political favourites (Adams, Graham and Von Pischke, 1984). The justification for its re-emergence is the balance between social and economic objectives of microfinance. For instance, the Income Generation for Vulnerable Group Development (IGVGD) run by the Bangladesh Rural Advancement Committee (BRAC) targets the destitute and as such has a strong inclination for its social mission. The compelling advocacy of financial systems approach provides a counterargument on the impact of subsidies.

The strategy, abandoned some years ago, has re-emerged in microfinance with much harder questions of extent, nature and time of subsidy utilization as against the either/or argument of subsidy. The current debate departs from the extremes and asserts the need on some form of subsidy, packaged in an 'ideal' manner and delivered to the 'right' beneficiary at the 'right' time. Open fields will always remain in an attempt to provide responses to these questions. For instance amount and time of subsidy depends on peculiar characteristics of both institutions and its clients and the extent of competition and/or influence of the immediate environment. Armendariz de Aghion & Morduch, (2005) posit that the amount of subsidy depends on factors including sensitivity of credit demand to interest rates, adjustment time between increases in income and well-being, returns to investment by poorer households and negative externality of subsidized credit programmes to other lenders.

The debate is further stretched on who receives the subsidy. For instance, directing subsidies to institutional strengthening of which clients at the outset will pay full recovery rate but indirectly benefit from structures such as credit bureaus that smoothens the delivery of financial services. From a more pragmatic perspective some institutions have rolled out client sourcing of subsidies over time and product. This allows for institutions to offer some non-financial services such as food aid, health and education at subsidized rate and latter or concurrently role-out commercial lending rate schemes. Though applauded for its relativity better intuitiveness the IGVGD programme of BRAC experienced a massive drop-out with clients that benefited for this intervention. Also closely related to this type of intervention is the emergence of cross-subsidy that segments the markets and discriminates in the pricing of loan. Segmentation has principally depended on the economic activity, repeated loans, repayment and sometimes perceived average returns of the economic activity. These have well been conceived from a theoretical perspective but most microfinance institutions grapple with its implementation. The main problem is attributable to lack of a thorough understanding of client responsiveness to pricing of loan.

Non-sensitivity of Interest rate

Theoretically positing a perfect inelastic demand for credit will lead to market failure at least in the frame of neo-classical economics. Paradoxically, in the microfinance setting this stand-point has dominated for more than two decades. The perception that microfinance is designed for the poor who live on the fringes of survival partially justifies the non-responsive to loan amount. That is, due to the dire need for money to survive and other market constraints such as non-competitive market environment and information asymmetry, cost of borrowing does not inform the decision to access a loan or otherwise. Morduch, (2000) prioritizes this view point for the 'win-win' rhetoric. The perception that raising costs of financial service does not diminish demand triggers off a fertile ground for possible consumer abuse. The likely consequence of this in a market-determined system is shifting total transaction cost plus inefficiency onto the client. The existence of information asymmetry in the market as a result of non disclosure of loan costs and entire portfolio by micro lenders also limits the options for the borrower.

Generally, ability to repay has been used as the benchmark for the success of microfinance programmes. What is not discussed are the strategies used for repayment and whether these translates positively to increased consumption and income and eventually well-being. Anecdotal evidence points to a situation where at the time of repayment, some household assets are sold out of distress. The adverse effect of this phenomenon is the creation of a vicious cycle of poverty. Karlan and Zinman (2008) related to the above assert that clients scout around and borrow from other source to repay loan.

Recent empirical studies on client sensitivity (Dehejia et al, 2005, Briones, (2007) & Karlan and Zinman, 2008) offer a contrasting outcome to the perceived borrowers insensitivity to changes in interest rate. The most recent study, Karlan and Zinman (2008) use randomized experiment to show that loan size is sensitive at the extensive margin of interest rate changes. This is observed in a hypothetical case of a 100 per cent increase in monthly interest rate. However, they observe that loan maturity is more responsive of loan size than interest rate changes. In line with our main hypothesis, Karlan and Zinman estimates the effects of targeting females and low income category of clients on a reduced. They observe that these groups show much stronger effects of loan size sensitivity to interest changes.

Emerging consensus from the recent studies is sensitivity of microfinance clients. Dehejia et al. (2005) and Karlan and Zinman (2008) categorically show that the poor has a much stronger sensitivity. Characteristic of these recent empirical studies is testing the hypothesis on a reduced sample. Though robustness is implied in most of the estimation techniques of the previous studies, compromising reliability as a result of using a reduced sample is inevitable. We are motivated by this to explore the same hypothesis using an alternative empirical method. Instead of estimating the effect of the poor's influence on a reduced sample we integrate poverty characteristics as a variable into the basic model. Quantile regression and interaction procedure in a least squares regression set-up are used to investigate the extent to which average returns (proxied by poverty status) moderates the relationship between loan size take-up and interest rate. Also, as demonstrated by

Porteous (2006) the need for a country specific study that explores institutional differences based on character type and source of funds is imperative.

3. Microfinance Industry in Ghana

In Ghana, the practice of sourcing funds from non-formal financial institutions dates back to 1955 when the Canadian Catholic Missionaries established the first credit union in Northern Ghana. The concept was expanded at the beginning of the 1970s with the establishment of the first rural bank at Nyakrom. Since the activities of such institutions were not considered as part of mainstream financial sector, their contribution to financial deepening was neither documented nor recognized until the latter part of the 1990s when issues of poverty reduction became part of developmental agenda. The shift from growth-led strategies to poverty reduction strategies provided an avenue for pro-poor policies and programmes. Recognizing access to credit as a major constraint to the promotion of pro-poor activities, a number of institutions (governmental and non-governmental) emerged to provide financial services to the poor.

In 1996, a number of groups involved in implementing micro-financing projects came together to form the Micro Finance Action Research Network (MFARN). The aim was to play an active role in policy discussion, formulation and implementation of programmes related to micro financing in the country. In 1998, the group changed its name to the Ghana Micro-finance Institutions Network (GHAMFIN). The objectives among others are to: strengthen the capacity of MFIs through training; sensitize government and stakeholders; contribute to the creation of employment opportunities; and provision of support and empowerment to the poor and excluded.

At the governmental level a number of ministries, departments and agencies (MDA) have established desks or units for microfinance activities. Among the MDA with microfinance programmes are Ministry of Finance and Economic Planning, Office of the Senior Minister, Ministry for Women and Children Affairs, Bank of Ghana, Ministry of Local Government, Rural Development and Environment. To co-ordinate and streamline activities of the industry, a central body, known as the Microfinance and Small Loans Centre (MASLOC) was established in 2006. Its mandate is to, co-ordinate all microfinance activities in the country, especially that of government programmes and complement the activities of other microfinance apex bodies.

The number of microfinance implementing institutions cuts across both formal and informal organizations. Five broad categories of institutions provide financial and technical services in the industry. These institutions are Rural and Community Banks (RCBS), Savings and Loans Companies (S & Ls), Financial Non-governmental Organizations (FNGOs), Credit Unions and Susu Collectors Association of Ghana. All these institutions have created their apex bodies and are spread in all the 10 regions of the country.

In addition, some formal banks and insurance companies have linked up either with some existing microfinance institutions or created a microfinance department. The heightened interest and concerns of microfinance activities in Ghana drives the exploration of

complementary services and signals the need for market growth towards competition. Perceived availability of effective demand for financial services partly explains stakeholders' sustained interest and concerns.

4. Methods of Study

Data Sources

Data for the study is based on a survey of client and non-client households in Ghana[7]. For the survey, the country was divided into northern zone, consisting of the Upper West, Upper East and Northern Regions, the middle zone made up of the Brong Ahafo, Ashanti and Eastern Regions and the coastal zone covering the Volta, Greater Accra, Central and Western Regions. Based on assessment of microfinance institutions by ARB Apex Bank, Credit Union Association (CUA) and GHAMFIN on the activities and the performance of their members, 16 institutions were selected from the three zones. In addition, an institution using Susu methodology to mobilize funds was selected, giving a total of 17 microfinance institutions. Clients of selected microfinance institutions were randomly selected and their households identified for the study.

Clients of four rural banks, one Credit Union and two Financial Non-Governmental Organisations (FNGOs), were selected from the coastal zone; in the middle zone, two rural banks, one credit union, and one FNGO were selected. Finally clients of three rural banks and one FNGO were selected in the northern zone. The 17 institutions provided funds from their own resources, or the government channelled through either the district assembly or a Ministry and donor sources such as International Fund for Agricultural Development (IFAD), the World Bank and other bilateral agencies.

To facilitate the test for sample selection effect, data on non-client households was assessed from the same study. A national representative data on 1102 non-clients households were randomly interviewed based on the framework of Ghana population census.

Data collected included socio-demographic and economic profile of clients' household, economic activities, employment history and institutional level indicators such as sources of finance and interest rates paid. Selected respondents were clients who had received loans for the first time within the last six months prior to the survey, or had been processed for loan.

The total sample size for the study is 2691 units consisting of 1589 clients and 1102 non-clients households was available for analysis. The sample varied at different stages of the analysis. For instance, based on institutional mandatory limitations on the loans mobilization clients of one of the five main categories were excluded in the final analysis. The mandate of susu[8], like FNGOs are restricted in receiving deposits. But in the case of

[7] Data for the study was merged from two Bank of Ghana/World Bank sponsored projects under the broad theme - 'Poverty Assessment and a Comparative Study of Rural Microfinance Institutions and Government Credit Programmes in Ghana. The Poverty Assessment was carried out by the University of Cape Coast in which the author was a member of the core team. The Financial Performance was executed by Mawuko and Co. Consulting Services.

[8] Quite recently, Barclays Bank, one of the biggest commercial banks in Ghana, has initiated a product that fosters collaboration with susu companies. Among the principal objectives is to increase scale of operation

FNGOs some linkages with other financial institutions have permitted them to engage in receipt and dispensation of financial services. Steel and Aryeteey (1994) caution on the exclusivity of susu operations. Also Steel and Andah (2003) categorize individual susu collectors as informal. The final dataset for the analysis was based on respondents from rural banks, credit unions, savings and loan companies and financial non-governmental organizations. The analysis was restricted to clients of institutions that had received loan amount within the six months period prior to data collection. A potential demise of this approach is sample selection bias which has been addressed in this paper. A total of 698 client households were analyzed. However exploratory and robustness check required additional dataset. The quantile regression estimation is based on a larger sample of 720 clients which includes respondents paying back only the principal amount. Also robustness check for sample selection problems required inclusion of non-client sample making the total sample 2650 (698 +1102).

Poverty Score Estimation

The study used the Microfinance Poverty Assessment Tool (MPAT) developed by the Consultative Group to Assist the Poor (CGAP) to construct a multidimensional poverty index. Based on the Principal Component Analysis (PCA), it combines various welfare variables including housing conditions and characteristics, food security and vulnerability, livestock and consumption assets to calculate a household relative poverty index. The MPAT method, as a measure of relative poverty, has the advantage of collecting cross-sectional data which can be used to construct a multidimensional poverty index (Henry et al, 2003). A poverty score of zero hypothetically denotes an average level of poverty, with the higher and lower scores connoting relatively less poor and extreme poor respectively. This meant that an institution with a better depth of outreach will have scores averaging lower than zero while institutions reaching less poor clients will have an average value greater than zero. Computed household poverty score normally ranges between ┌ 3. Poverty scores for clients of selected microfinance institutions ranged from -1.515 (reaching the poor – better outreach) to 1.204 (reaching the less poor) with a mean poverty score of 0.2847. Averagely all the institutions were reaching less poor clients. (See Appendix 1 for some more detail and table 1 for the variables that emerged finally for the computation of household poverty scores).

Insert table one here

For comparison, figure 1 below categorizes client respondents into five groups. Household indices are arranged in ascending order and classified into quintiles. In this sense the MPAT is applied in a comparative context by categorizing respondents into groups. This approach permits ranking poverty groups from extreme poor to non-poor. As evidenced in figure 1 below, the cut-off for extreme poor category (bottom twenty percent) is -0.81.

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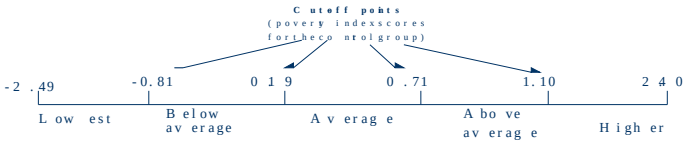
which implies exploration of deposit taking opportunities. Anecdotal evidence suggests that this has led to increased cost of operation and subsequently interest rates.

Figure 1:
Definition of Quintiles



The choice of quintile classifications over other cluster options is informed by the recent outcome of the category of extreme poor households in Ghana. Ghana Statistical Service 2007 shows a national extreme head count poverty of one out every five persons. This benchmark is important for validation and consistent policy direction.

We validate the poverty measure of the current study with the 2005 national living standard measurement survey. Comparing the patterns of poverty for these two datasets across administrative regions of the country, we observe a 91 per cent degree of association. Also similar patterns of poverty were observed based on broad rural/urban classification and ecological zones (Appendix II, Figure 2).

Specification of Econometric Models

The model specification is consistent with standard demand for loan amount theory. The apriori expectation of an inverse relationship is explained by the following two plausible transmission mechanisms. The first argument, typical to microfinance operations asserts that relatively higher cost in administering smaller loans underpins the inverse relationship. In other words as the loan amount increases per unit cost of administering reduces. The second reason subscribes to models of consumer inter-temporal choice that predicts a downward sloping demand curve with respect to price.

Parametric Quantile Regression and Least Squares Estimation

Inspired by the restrictions of Gaussian assumptions of linearity and zero conditional mean, Koenker and Basset (1978) proofs that for any distribution that the median is a better measure of location, the regression median[9] is more efficient. In contrast to least squares assuming that the expected value of the error term conditional on the covariates is zero, quantile regression sorts the data and identifies a threshold (τ) to estimate the coefficient (β) that minimizes the sum of absolute residuals. The general set-up of quantile regression, equation 3.1 below is solved from an optimization perspective using linear programming.

$$\hat{\beta}_{(\tau)} = \arg\min_{\beta_\tau \in \Re^K} \sum_{i=1}^{n} \rho_\tau \left(y_i - x'_i \beta \right) \qquad 3.1$$

[9] The proof of the median regression can is easily replicated for other to other percentiles (quantiles).

Where estimated $\beta_{(\tau)}$ called 'tauth' (τth) regression quantile estimates the coefficient at a specified threshold (τ). τ is the sample quantile and takes on any value that between 0 and 1. The expression $\rho_\tau(y_i - x'_i\beta)$, the absolute value function, weights the absolute difference between y_i and $x'_i\beta$ with τ and by $(1 - \tau)$ for all observations below the estimated hyperplane. Koenker and Basset (1978) estimates conditional quantiles using the minimization procedure synonymous to least squares.

Interaction Procedure

The observation of varying interest rate at different percentiles of loan size pre-empts an investigation of the factors likely to affect the relationship between interest rate and loan size. Karlan and Zinman (2008) identify external factors of targeting females and low income category of clients as potential influences on the relationship between interest rate and loan size. Based on this, we apply the interaction method to least squares and compare our results with the subsamples used in other approaches. The study's hypothesis informs the specification of a functional relationship positing that the effect of interest rate on loan size is moderated by the socio-economic well being of the client. This translates into the specification of equation 3.2.

Jaccard and Turrisi (2003) suggests the need for an initial null hypothesis test to verify the presence of an interaction term in a model. The null hypothesis asserts that the regression coefficient for the product term is zero. Also assessing the strength and nature of the interaction term further justifies the choice statistic to be estimated based on the theoretical and intuitive propositions. The exploratory test uses the basic multiplicative approach to interact the two continuous terms of poverty scores and interest rate in our model. The test for the two equations (with and without the interaction term) indicates an F-value of 30 implying the presence of a statistical interaction between poverty score and interest rate in the loan size equation. In this paper, we assume linear[10] dependence between poverty score and interest rate. We therefore reject the null hypothesis and confirm the assertion of Dehejia et al. (2005) and Karlan and Zinman (2008) that the poor moderates the relationship between interest rate and loan size. The strength of the relationship from the multiplicative perspective shows that the interaction effect accounts for 2 per cent of the variance in loan size. Interpreting coefficients in a model with an interactive term, especially in the case of multiplicative interacted variables is always received with a pinch of salt. Aiken and West (1990) and Jaccard and Turrissi (2003) both suggest potential problems, notably multicollinearity in interpreting equation 3.3 given product terms added to the right-hand side variables.

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_3 Pov * Int.r_i + \beta_4 X + e_i \qquad 3.2$$

Where LS is the loan amount, Pov is the household poverty score; Int.r is the interest rate Pov*Int.r is the interaction for the centred variables of household poverty score and

[10] We are cognizant of the other dimensions of dependence such as varying relationship along the slope and shape culminating into a non-linear relationship between poverty score and interest rate. But for brevity we limit the discussion to a theoretical bilinear relationship.

interest rate and X is the vector of other household factors that influence demand for loan amount. Specifying the equation in this form, asserts that the interest-responsiveness of the ith borrower can be inferred from the derivative (equation 3.3) and the predicted amount of loan size is dependent on the poverty rate of client (equation 3.3).

$$\partial LS_i \Big/ \partial Int.r_i = -\hat{\beta}_2 + \hat{\beta}_3 \, Pov \qquad 3.3$$

Aiken and West (1990) compare uncentred and centred variables in estimated equations and conclude that centred analysis be employed as it facilitates a more intuitive interpretation for interacted variables. With this background of evidence we explore the interaction effect in more detail using specific statistic (mean and different percentiles) of the moderating variable, poverty scores.

Second Stage Estimations

We undertake Instrumental Variable (IV) and Heckman second stage estimations to correct for plausible endogeneity and selection bias respectively. Though the likely incidence of reverse causality is minimised with a restricted sample of new clients and current amount of loan take-up, endogeneity is still plausible. Multiple sources of endogeneity including omitted variables are likely to bias our estimates. Specific to this paper, institutional features that complement the effect of interest rate on loan size is likely to affect our equation via an omitted variable perspective. Typically, one can argue that institutional performance can cause interest rate endogeneity. Identifying operational self sufficiency[11] as an instrument for interest rate and measure of institutional performance we address the two pronged requirements for the use of IV. The initial testable requirement shows that the correlation between interest rate and operational self sufficiency is 0.40. The second pre-requisite which requires intuition and theory points to a minimal association between operational self sufficiency and the error term of the loan size equation. We argue that due to institution's risk perception of first and repeated loans[12] restricting the sample to new clients nullifies the plausible effect of institutional performance on amount of loan disbursed. In view of the above, we propose that the interest rate coefficient is biased downwards as a result of the inverse relationship between the instrument and loan size on one hand and positive relationship between interest rate and operational self sufficiency.

In the case of sample effect, Armendariz de Aghion, and Morduch (2005) points out that impact studies in microfinance are decidedly mixed as a result of methodological issues including selection bias. We correct for sample problems that emerge on the premise of; (a) probability of an individual participating in a microfinance programme and (b) likelihood of being a member and accessing a loan. Identifying an exclusive variable for the participation equation is always daunting given the demise of a trade-off in the

[11] Operational Self Sufficiency is measured as financial revenue/ (financial expense + net loan loss provision expense + operating expense). The unadjusted subsidy effect explains the effect of donors and government in amount of loan disbursed.

[12] Anecdote suggests that microfinance institutions use donor and government grants mostly for first time loans and as such are not very particular about its effect on the sustainability of their operations.

efficiency of our results. The potential of huge standard errors in second stage estimation is verified by comparing our results with least squares. Occupational category of respondent that is either self employed or otherwise is used as the exclusive variable. The choice of this variable is rationalized by the preponderance of self employed entrepreneurs in microfinance.

We therefore estimate an outcome equation as;

$$LS_i \mid x_i ; Cl_i = 1 = \alpha_1 X_{1i} + \sigma_{12} \hat{\tau}_i (\hat{z}_{4i}' \gamma_4) + \eta_i \qquad 3.4$$

Where σ_{12} denotes the error term emerging from the participation and outcome equations; $(\hat{z}_{4i}' \gamma_4)$ is the variable representing Inverse Mills Ratio (IMR) for each of the observed households computed from a participation equation; τ is the coefficient of the IMR and η_i is the normal stochastic term for an OLS and X is the vector of covariates in our outcome equation.

Finally, to compare our approach to that of previous studies, we estimate interest rate effect on two sub-samples. Equations 3.5 and 3.6 specify the estimation of two sub-samples {poorest sample (bottom twenty per cent) and non-poor sample (upper eighty per cent)}. Categorization of the sample into quintiles and the exploratory outcome of the box and whisker plot informed the specification of the two broad regressions. As observed, the variability between the poorest twenty per cent and the other group is both economically and statistically significant[13] Equation 3.7 estimates a restricted model that includes a dummy to capture the effect of poverty.

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + e_i \qquad 3.5$$

(Poorest Sample)

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + e_i \qquad 3.6$$

(Otherwise Sample)

$$LS_i = \beta_0 + \beta_1 Pov_i - \beta_2 Int.r_i + \beta_4 X + \beta_5 Non-poor_i + e_i \qquad 3.7$$

(Unrestricted Model)

We apply the traditional Chow Test[14] to examine consistency in slope coefficients between the unrestricted (equations 3.5 and 3.6) and the restricted (equation 3.7) models. Equations 3.4 and 3.5 are tested concurrently against the restricted model of equation 3.7. Though robust estimation to a large extent have been meticulously considered at different stages of this study we are humble in asserting a definite uni-causality from interest rate to loan size due to the cross sectional nature of our dataset.

[13] Calculated t-value for the difference in average interest rate between the bottom twenty per cent and the upper eighty per cent is 4.5 denoting statistical significance of the variation for the two groups.

[14] The Chow Test like any other F-test, tests the hypothesis of equal slopes in the different subsamples (See Wooldridge 2006).

5. Results and Discussion

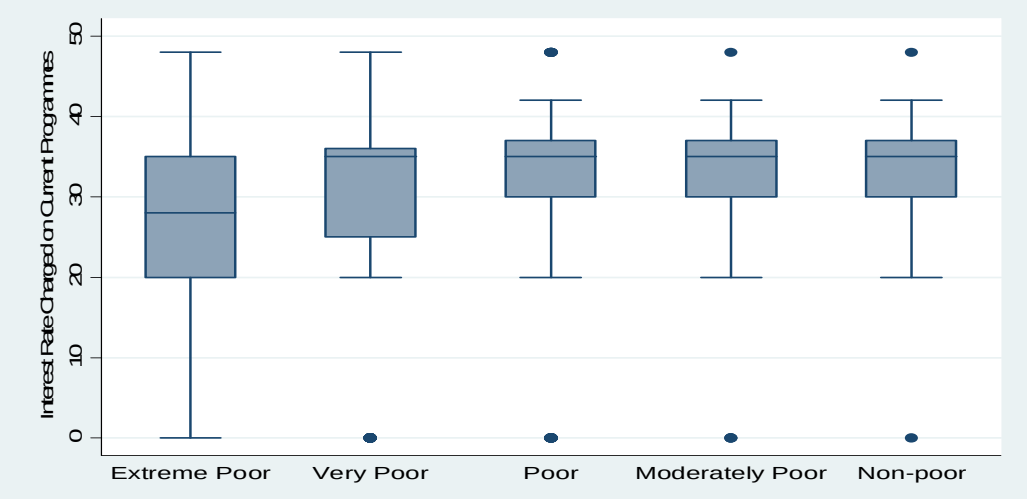
The central hypothesis posits that loan size sensitivity will have varying slopes as a result of the different socio-economic characteristics of clients. Karlan and Zinman (2008) observed a kinked demand curve confirming stronger sensitivity effect at the extensive margins of interest rates. Though quite informative, we suspect that limiting the empirical investigation to a subsample blurs a possible higher frequent and deeper variation in loan size responsiveness among microfinance clients. Table 2 presents the mean and different percentiles of interest rates for each of the quintiles. The former underpins regression analysis (maximum likelihood and least squares) used in previous studies and the latter justifies our choice of quantile regression and application of interaction procedures.

Insert tables 2a and 2b here

Tables 2a and 2b clearly evidence the extent to which use of mean suppresses variations at different percentiles. The box and whisker plot of figure 3 shows that the minimum and maximum interest rates are not restricted to a particular category of clients. Table 2a describes the loan amount received by different poverty quintiles. We observe different levels of variability between the groups based on the choice of statistic. While the mean shows a difference of about 30 times between the extreme and very poor the median accounts for a 3 times difference. Comparing figure 3 and table 2, heterogeneity in interest rate is observed at the lower end of the socio-economic distribution. For instance, the fifth percentile shows 0 per cent interest rate for the very poor category compared to 20 per cent for the other groups. Also at the extensive margin it is observed that the 95th percentile is 48 per cent for the extreme poor category compared to 42 per cent for the other groups. Also, interest rates tend to vary in an inconsistent fashion for the different categories of extreme and very poor clients. At the other end, changes in interest rates across the quantiles tend to show consistent variations for the poor to non-poor category. This observation makes the use of least squares susceptible to a blurred response as it is premised on the mean which shows an increase in average interest rate from extreme poor to non-poor. The difference among groups based on choice of statistic has implications in drawing inferences and predictions using higher level estimation techniques precedent on either the mean or the median.

FIGURE 3:

Interest rate for Different Socio-economic Groups of Borrowers



In table 2 we show the distribution of interest rates across the five socio-economic categories of microfinance clients at the mean and different percentiles. Noticing with much alacrity is the twist at 5th percentile which shows 0% lending rate for the very poor category compared to 20% for all the other groups including the extreme poor. This observation suggests a platform of plausible market distortion detrimental to the long term sustainability of microfinance. The uni-variate statistics of Table 3, offer a comparison between interest rate charged and the simple average of poverty score for various programmes[15] of the respective microfinance institutions. The annualized[16] nominal[17] interest rates charged ranged from 0% to 48% with a respective mean and median of 32% and 35% for all the programmes of the institutions. The wide range of 48% characterizing microfinance evokes concerns on why and who benefits and pays what. The observed mean lending rate of 32% (Table 2) is more than twice the prime rate of 14.5% and about 11% more than the borrowing rate of traditional banking institutions to the public.

Insert table three here

In an earlier empirical paper, Amonoo et al. (2003) observe that the mean nominal lending rate to the poor in the Central Region of Ghana is about 45% per annum. In table

[15] Programme in this study is defined as the source of funds. That is either institutional own mobilized funds, sourced from donor or government. For the purposes of analysis we generate dummy for own programme interpreted as institutional mobilized funds and otherwise. The rationale is that funds sourced from donor and government are external to the institution.

[16] Worth mentioning is the use of adjustment factors. Due to the varied approaches of handling interest rate overtime including 'reducing balance' and 'flat' method, we annualize all the rates and adjust all methods of calculation to the 'flat method'. The 'reducing balance' method calculates interest rate based on the balance while the 'flat' method is based on the principal.

[17] A logical argument will be to apply either real or effective interest as the unit of analysis is the household. However due to respondent's lack of ability to quantify other transaction cost and variations in personal inflation rate we use the nominal interest rate.

2, the average lending rate of shows a much lower rate by 13% points. A potential source of variation is the different scope of the two studies. Since the current study is nationally representative, characteristics of the respondents in peri-urban and urban areas are likely to influence interest rate. The notion that transaction cost are higher in dealing with poor clients might be a potential justification for the high interest rate of 45% in the previous study as it was conducted in one of the four poorest regions of Ghana. To the contrary we observe from the study that while the mean shows higher lending rates for less poor clients the evidence is mixed at different percentiles. This signals other influences on lending rate such as source of funds. From table 3 we observe that the cost of accessing a loan funded by the Government was on the average a third lower than programmes dispensed with own funds. This augments contemporary knowledge that institutional funds mobilized through owner's equity, savings and shares are geared-up for commercialization as opposed to external funds (Rhyne, 1998).

The last column of Table 3 shows the poverty scores of client's households. The results indicate that RB2 with scores of -1.1513 and -1.515 for its two programmes and FNGO1 with a score of -1.1187 report reaching very poor clients. The principal reason accounting for this is the location of the institutions. These institutions are located in the northern part of the country where poverty is most endemic. Annim et al. (2008) assesses the spatial dimension and implication of microfinance institutions in Ghana.

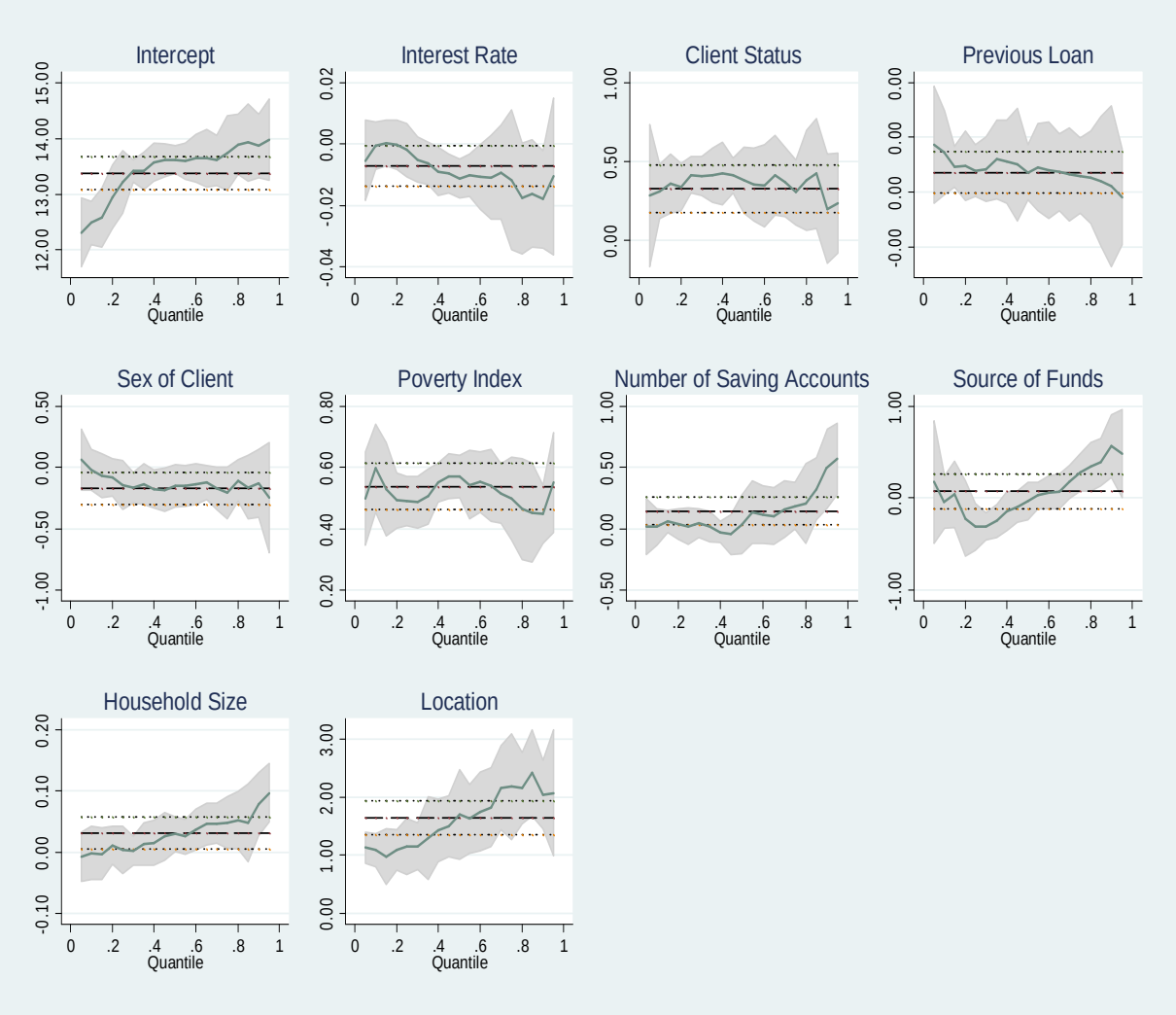
Multivariate Analysis

Figure 4, demonstrates concisely the quantile responsiveness of loan size for each of the covariates. For brevity, we restrict our discussion to the main covariate interest rate and factors most likely to influence targeting (poverty and sex of client). The thick dashed line plots the respective least squares coefficient and the light point dots are the confidence intervals. The quantile regression coefficients are represented for the various percentiles with the curved lines and respective confidence intervals are shown with the dim background. At a glance, we observe broadly that interest rate, show inconsistent responsiveness of loan size at different quantiles. The least squares shows that marginal upward variation in interest rate results in a 0.7 (less than unitary – table 4) downward change in loan size. But the question remains as to whether this is consistent across all the segments of the distribution. The quantile regression shows that the change is much higher for the lower quantile (up to about 40th), fairly stable for the middle quantile (between 40th and 65th) and falls further for the higher quantiles.

Insert table four here

Sex of client, on the other hand demonstrates fairly consistent results for both least squares and quantile regression. The only observable variation is at the lower quantile of a difference between male and female clients higher than 17 per cent. With both covariates, the respective 5 per cent significance level observed from the least squares, is not consistent across the quantiles (Table 4). The inconsistency incites probes into the resilience and reliability of the least squares estimates. We address, these probes by exploring the interaction effect and checking for robustness using second stage estimation techniques.

Figure 4
Least Squares and Quantile Regressions Coefficients



Based on the observation from the quantile regression and the empirical verification of the presence of an interaction term in section 4, we hypothesise that client well-being moderates the effect of the relationship between loan size and interest rate. The first column of table 5 presents the model with the interactive term at the centred predictor, moderator and their interaction. We opt for centred of the variables as explained in section 4 of the paper. We estimate this relationship bearing in mind the effect of other covariates including; number of savings account held by the borrower, location, sex of client, household size and others (see table 5). The interpretation of the sign and coefficient of the predictor with an interaction generates much complexity depending on the statistic of the moderating variable (Wooldridge 2006). Our initial result at the centred value is to provide an intuitive interpretation of equation 3.2 at the mean poverty rate. Thus the semi-elasticity of interest rate to loan size is quite marginal (0.2%, relatively inelastic) and insignificant. This provides an insufficient evidence to reject the

null hypothesis of microfinance client insensitivity. This initial result runs parallel to recent studies (Dehejia et al (2005), Briones, (2007) and Karlan and Zinman, (2008)) of an elasticity coefficient close to unitary.

Insert tables five and six here

Table 6 compares interest rate at varied statistic and offer a deeper insight as to which category of clients is sensitive. Each percentile of the interaction variable describes a segment of clients' socio-economic characteristics. The choice for the 20th percentile is informed by the extreme poverty statistics in Ghana and also the evidence of a high coefficient of variation for this group (table 2). The 50th and 75th were selected due to the basic standardization of these percentiles. Column 3, Table 6 shows that estimating equation 3.2 at a value that describes the characteristics of the very poor (20th quantile), the responsiveness of loan size to interest rate changes is more than unitary (2.4%), downward sloping and significant at less than one per cent. This shows strong responsiveness by the extreme poor and offers consistent finding with earlier studies. However in each of the other statistic either the coefficient is not significant (mean and 50th percentile) or it shows a positive sign (50th and 75th percentiles).

The significant inverse response of loan size to a unit change in interest rate literally implies that poorer clients' dropout with higher interest rates. This finding might suggests some reasons for the failure of the IGVGD programme in Bangladesh. We are tempted to support the preposition that microfinance is ideal for a particular segment of poor clients normally tagged as 'brave poor'. The labelling of microfinance clients as 'brave' can be interpreted from the perspective of the upper eighty per cent that are non-responsive to interest rate changes. Assuming non-responsiveness imply repayment it is utterly important to identify channels of repayment. Among the unconventional means adopted by clients to repay include; multiple borrowing from different institutions and sale of assets. Some anecdotal evidence suggests suicidal tendencies in the long-run when both conventional and unconventional modes for repayment are exhausted.

Columns 2-5, table 5 offers a comparison both within and between the current study's approach and the use of subsamples. Comparing the coefficient of interest rate for the subsample of the bottom twenty percent with the interaction term of the 20th percentile we observe a consistent sign and significance level. Though in both estimates we observe a more than unitary loan size responsiveness the difference of about 2 per cent is worth considering. Worth observing from all five columns a downward sloping demand curve for all estimates but the non-poor sample. The outcome of positive coefficient is supported by the 50th and 75th percentiles in table 6.

We estimate equations 3.5 to 3.7 to empirically test differences in regression slopes across groups. In our context, it is the bottom twenty percent (column 2, table 5) vis-à-vis the non-poor sample (column 3, table 5) compared with the restricted model (column 4, table 5). The significant chow test value of 14.47(0.000) imply the rejection of the null hypothesis that the slopes do not change if the subsamples used. This finding upholds the

need to formally include a variable capturing the socio-economic characteristics of the poor into the estimation model instead of estimating subsamples as offered in previous studies.

Table 7 offers second stage estimation results that seek to correct for endogeneity and sample selection problems. Correcting for endogeneity, we observe that the interest rate coefficient increase by a margin of 0.06. The use of operational self sufficiency which is positively correlated with nominal interest rate and inversely related with loan size resolves the plausible underestimation. This suggests that using effective interest rate is likely to show greater responsiveness relative to nominal interest rate. The Hausman test shows that the IV coefficients are better in spite of the huge standard errors.

Insert table seven here

Columns 4a and 4b address the problem of sample selection from two perspectives. The first perspective (column 4a) compares the effect of restricting the sample to only those who accessed loans vis-à-vis other microfinance clients and the second stage compares the former with both clients and non-clients. We propose that self selection into microfinance programmes and ability to assess a loan is determined by whether the respondent is self employed or otherwise. The general belief is that self employed people self select themselves into microfinance programmes as non-self employed respondents are likely to have assess to traditional financial institutions and other sources of funds. The sample selection indicator (sigma) shows a much higher effect between those whose assessed loans and other microfinance clients. The test of independence between the participation and the outcome equations also show significant results. Although, the variation in interest rate is not huge it worth commenting that correcting for selection problems leads to significant changes in other covariates such as client status and source of funds.

6. Conclusion

Achieving financial sustainability and reaching very poor clients concurrently, has been the prime discourse of microfinance paradigm. The expectation is to provide services to the poor at low effective interest rates. Through this an institution achieves the dual purpose of reaching the poor and providing services on a commercial scale. Behavioural patterns of clients of MFI seem to vary in view of their different socio-economic well being. The major conclusion of this study supports recent findings of microfinance client sensitivity to interest rates changes but with a strong caveat. We assert the variability of borrower's responsiveness to interest rate in contrast to ascribing generic sensitivity for all microfinance clients. Poorest clients show significant and more than unitary responsiveness to loan amount for a marginal increase in lending rate. Among the main plausible reasons for this observation is the theoretical knowledge of the poor's aversion. Secondly, the dominance of group lending mechanism among the poorest group compared to the non-poor potentially reduces information asymmetry leading to rationale economic behaviour of reducing loan amount as interest rate increases. Thirdly, poorer clients are likely to have less resilience to shocks and as such have a higher probability to decline in assessing more loan as it price increases. The non-responsiveness of less poor

clients can be associated with their enthusiastic desire to make a living ('brave poor') making them at least risk neutral if not lovers. While one could surmise other reasons including limited supply of loan market alternatives this is one area that needs further empirical exploration as part of the process of deepening the outreach of institutions.

The observed upward responsiveness between the second-stage instrumental variable and the first-stage estimations suggests the need to analyse clients' responsiveness from the perspective of their cost rather than institutional nominal interest rates. Cost from the perspective of clients reveals the difference between nominal and effective interest rates. Estimating the responsiveness from these two perspectives suggests the ineffectiveness of intervention strategies such as interest rate capping since institutions are able to pass on cost to clients through other channels other than phase value (nominal) interest rates.

Microfinance proponents have argued with the arsenal that the poor are capable of paying back loans with minimal consideration to hurdles encountered during repayment. Although some category of clients may be insensitivity to interest rate as observed from the study, theoretical prepositions of adverse implications such as moral hazard and adverse selection roars at the long term success of reducing poverty and augmenting main stream financial sector. We subscribe to recent market segmentation advocacy but propose the use of borrower's responsiveness to complement traditional client differentiation methods including type of economic activity and community level indicators. This will enhance the achievement of client specific needs to complement location specific and type of economic activity driven needs. Secondly a broader interventionist approach should be employed in the case of subsidy use. In this light, sensitivity thresholds will always pre-determine a likely drop-out. In a comprehensive sense, to prevent drop-out of poor clients as experienced from the IGVGD programme in Bangladesh synergies between financial products, institutional structures and client socio-economic characteristics should be timely and concurrently administered.

Areas for further work points to the use of extensive datasets to explore bi-causality between loan amount and its price in the case repeated loans. Also issues of effective interest rate and higher-order interactive terms that includes repayment rate, loan schedules and economic activity will offer in- depth policy direction for practitioners of clients responsiveness to a blend of strategies.

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APPENDIX I

ESTIMATING POVERTY INDEX - MICROFINANCE POVERTY ASSESSMENT TOOL

The theoretical underpin of the Microfinance Poverty Assessment Tool (MPAT) as developed by the Henry et al (2003), is multidimensional poverty in contrast to uni-dimensional poverty that has attracted huge criticisms due to its narrow perspective. In developing economies, where varied assets do not easily translate into either an income or money metric measure such approaches attract enormous variability due to measurement error. The multidimensional approach seem more convincing as the pool of a multiplicity of factors attaches relative importance to a number of dimensions to estimate well-being. Compared to the Living Standard Measurement Survey (LSMS) which is credited for its detail, the MPAT approach is less expensive, time saving and more importantly uses both ordinal and cardinal variables in its approach to estimate a household index. The latter surmounts the LSMS strict adherence to a monetary and an absolute approach. The MPAT relaxes on these rigid approaches and caters for ranked variables, subjective perspectives, relative approach and comprehensible scope of poverty.

In the context of multidimensional approaches, MPAT possesses peculiar merits of assessing poverty relative to other methods such as Rapid Appraisals and Participatory Appraisals. Both approaches to the measure of poverty are dominantly subjective as they are mainly people-centric in nature. Though this allows for a holistic and reflects entirely the experiential levels of poverty, complications tend to emerge if opinions of the community leaders are at variance with that of households in the case of Rapid Appraisals and also when a researcher has to deal with large sample sizes for the Participatory approach. The MPAT operates midway and chooses a sample to estimate a poverty score, then applies an arbitrarily cut-off poverty point to segment the sample into different categories. This invariably permits some degree of an objective approach, though the arbitrary choice of the cut-off that is either terciles or quintiles is subject some degree of criticism.

The approach collects household level data using a contextualized generic instrument which has six main subcomponents. The subcomponents of the instrument are; (See Appendix 2 for the detailed instrument used for this study).

- Demographic structure and economic activities
- Footwear and clothing expenditure
- Food security and vulnerability
- Housing indicators
- Land ownership
- Ownership of assets

Indicators for each of these components are structured to elicit both ordinal and ratio-scaled data. For instance, while specific questions on footwear and clothing expenditure elicit ratio-scaled data, food security obtains information on a ranked

basis such as *'how many times was food served in the past two days'?* Questions of this nature transcend the narrow perspective of a money-metric perspective of poverty and provide further information on, for instance, food security, coping mechanisms, depth of poverty and vulnerability.

The estimation procedure is built on main two descriptive statistical methods. First Linear Correlation Coefficient (LCC) and second the Principal Component Analysis (PCA). The MPAT approaches the computational measure with a bias for household per capita expenditure on footwear on clothing as this is chosen as the benchmark variable. The choice of this variable though arbitrary is consistent with the level of prominence accorded to this variable in the early work of Streeten et al 1981 on basic needs. The LCC is the primary means of filtering poverty indicators to ascertain variables that best captures variations in relative household poverty (Henry et al, 2003). The initial step is to run a bivariate correlation test of all the other indicators against household per capita expenditure on footwear and clothing. The statistical criteria of $P<0.01$ and $P<0.05$ significance levels have been designated to identify variables that correlate very strongly and strong respectively. A table ranking the variables based on the level of significance, value and sign of correlation matrix and number of cases with missing values is generated to facilitate the implementation of the PCA.

The PCA enables the extraction of a poverty component that can be used to extract a household specific index of relative poverty. It is capable of achieving this objective as it initially filters variables that have a strong correlation with a poverty benchmark indicator. Each component extracted captures a unique attribute shared by survey households on the presumption of their relative poverty characteristics. This does not preclude the presence of other associative reasons such as geographical location, cultural practices and occupation. To minimize the extent to which other reasons might lead to the extract of components other than the poverty component further filtering at the initial stage is done to limit to indicators to variables that are very strongly correlated with household per capita expenditure on footwear and clothing. Some degree of intuition is applied to reduce the number of indicators, for instance, number of missing values for a particular indicator, a cluster of a number of indicators for one component and spread of indicators to capture other dimensions.

The PCA allows for the computation of a linear combination of indicator variables. The 'component-loading' which represents the amount of correlation between the component variable and the indicator variable is successively revised based on factor analysis to arrive at a household relative poverty score.

APPENDIX II - FIGURES & TABLES

Table 1
Variables used in constructing poverty index

Components	***Indicators***
Geographical Location	Urban or Rural location in rural savannah
Food Security and Vulnerability	Coping Strategy: frequency of reducing number of meals
Quality of the House	Index for type of ownership, access to water, electricity, quality of roof, walls toilets, etc.
Assets of the Household	Motorcycle, bicycle, TV, stereo, radio, fridge, stove, sewing machine, fan, iron, etc.
Access to basic needs	Time (in minutes) to the nearest secondary school and pharmacist.
Education	Literacy and level of schooling of HH head, per cent of adults who have completed primary schooling, ratio of literate adults
Occupation	Number of adults self-employed in food crop agriculture and distance to the nearest food market.
Expenditures	Clothing and footwear expenditures per person.

Figure 2
Data Validation

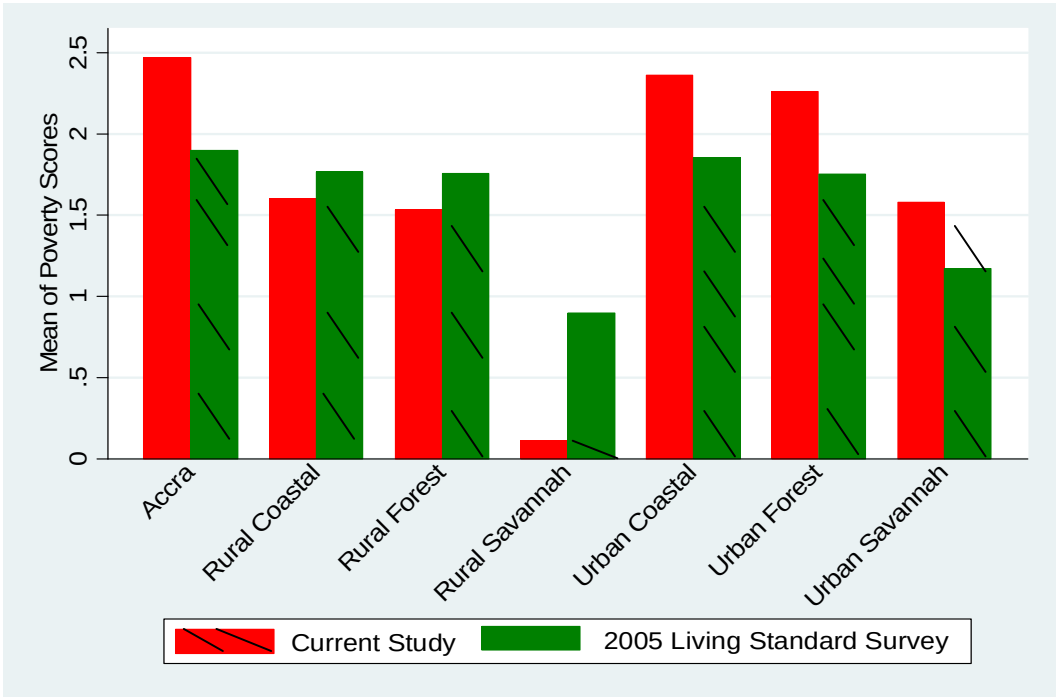

Table 2a
Loan Amount by Poverty Quintiles

Poverty Groups	N	Mean	Max	Min	Median
Extreme Poor	120	¢45,628	> ¢2,000,000	¢30,000	¢335,000
		US$5.06	*US$221.78*	*US$3.33*	*US$37.15*
Very Poor	153	¢1,284,999	> ¢10,000,000	¢50,000	¢1,000,000
		US$142.49	*US$1,108.89*	*US$5.54*	*US$110.89*
Poor	155	¢1,511,087	> ¢10,000,000	¢100,000	¢1,000,000
		US$167.56	*US$1,108.89*	*US$11.09*	*US$110.89*
Moderately Poor	124	¢2,271,049	> ¢40,000,000	¢100,000	¢1,000,000
		US$251.84	*US$4,435.57*	*US$11.09*	*US$110.89*
Non-Poor	146	¢5,805,849	> ¢80,000,000	¢100,000	¢2,000,000
		US$643.81	*US$8,875.17*	*US$11.09*	*US$221.78*
Total	698	¢2,313,587	> ¢80,000,000	¢30,000	¢1,000,000
		US$256.55	*US$8,871.15*	*US$3.33*	*US$110.89*

Table 2b
Interest Rate by Poverty Quintile

Poverty Quintiles	N	Mean	P5	P25	P50	P75	P95	Coefficient of Variation
Extreme Poor	317	30.49	20	20	28	35	48	0.324
Very Poor	320	30.68	0	25	35	36	42	0.213
Poor	318	32.52	20	30	35	37	42	0.183
Moderately Poor	317	33.06	20	30	35	37	42	0.188
Non-Poor	317	33.60	20	30	35	37	42	0.162
Total	**1589**	**32.07**	**20**	**28**	**35**	**37**	**48**	**0.220**

Table 3
Poverty Scores and Interest Rate Charged by Institution and Programme

MFI		Source of funds	Interest rate per annum	Poverty Score
CU1		Deposits	25%	1.057
RB2		Deposits	28%	-1.513
		Donor	25%	-1.515
RB3		Deposits	35%	-0.722
FNGO1		Donor	48%	-1.187
FNGO2		Donor	35%	0.924
		Deposits	35%	0.924
S & L		Deposits	7%	1.204
RB4		Deposits	36%	0.503
		Government	36%	0.274
FNGO2		Deposit	25%	0.238
RB5		Deposits	35%	0.023
		Government	0%	0.665
RB6		Deposits	42%	0.767
RB7		Government	20%	-1.374
		Donor	20%	-1.097
RB8		Government	20%	0.797
		Deposit	34%	0.561
RB9		Deposit	30%	0.709
		Deposit	30%	0.974
		Government	20%	0.555
		Government	20%	0.365
CU2		Deposit	36%	1.167
FNGO3	Ashanti	Deposit	37%	0.483
	Volta	Deposit	37%	1.057
	Eastern	Deposit	37%	0.957
	Brong Ahafo	Deposit	37%	0.642
SUSU		Deposit	-	1.226

Table 4
Least Squares and Quantile Regression Estimates

Dependent Variable: *Amount of Current Loan Take-up* ***Explanatory Variables***	***Coefficients & Standard Errors [Robust and Bootstrapped]***					
	Least Squares (1)	**Quantile**				
		(2) 10th	**(3) 25th**	**(4) 50th**	**(5) 75th**	**(6) 90th**
Interest rate	- 0.007 *(0.003)***	- 0.000 *(0.003)*	- 0.002 *(0.003)*	- 0.011 *(0.003)****	-0.012 *(0.008)*	- 0.018 *(0.007)***
Client Status	0.327 *(0.077)****	0.308 *(0.097)****	0.414 *(0.077)****	0.380 *(0.109)****	-0.302 *(0.119)****	0.200 *(0.180)*
Amount of Previous Loan	0.000 *(0.000)***	0.000 *(0.000)**	0.000 *(0.000)*	0.000 *(0.000)*	0.000 *(0.000)*	0.000 *(0.000)*
Sex of Client	- 0.170 *(0.066)***	- 0.018 *(0.096)*	- 0.141 *(0.080)**	- 0.148 *(0.091)****	- 0.207 *(0.091)***	- 0.127 *(0.120)*
Poverty Score	0.538 (0.037)****	0.598 *(0.066)****	0.491 *(0.046)****	0.572 *(0.045)****	0.499 *(0.064)****	0.448 (0.080)****
Number of Savings Account	0.145 *(0.075)***	0.016 *(0.099)*	0.019 *(0.065)*	0.035 *(0.122)*	0.188 *(0.086)***	0.492 *(0.151)* ****
Source of funds	0.074 *(0.083)*	- 0.042 (0.163)	- 0.311 *(0.121)****	- 0.030 (0.089)	0.281 *(0.113)***	0.571 *(0.182)****
Household size	0.031 *(0.014)***	- 0.011 *(0.020)*	0.003 *(0.017)*	0.029 *(0.015)***	0.048 *(0.020)***	0.078 *(0.023)****
Location	1.485 *(0.200)****	1.085 *(0.201)* ****	1.151 *(0.256)****	1.703 *(0.345)* ****	2.178 *(0.357)****	2.041 *(0.187)* ****
Constant	13.377 *(0.151)****	12.486 *(0.153)****	13.222 *(0.237)****	13.620 *(0.154)****	13.740 *(0.250)****	13.870 *(0.300)****
R-Squared	**0.48**	**0.36**	**0.23**	**0.22**	**0.29**	**0.34**
Number of Obs.	**720**					
Wald Test (Comparing with 50th Percentile)		**F = 5.53 (0.02)**	**F = 5.10 (0.02)**		**F = 0.00 (0.95)**	**F = 0.68 (041)**
	0.000					

**** Significant at one percent; ** Significant at five percent * Significant at ten percent*

Table 5
Interaction Effect and Reduced Samples

Dependent Variable *Amount of Current Loan Take-up*	***Coefficients & Robust Standard Errors***				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Explanatory Variables	**Interaction Term**	**Poorest Sample**	**Non-Poor Sample**	**Impose Restrictions**	**Without Interaction term and Dummies**
Interest rate	-0.002 *(0.005)*	- 0.044 *(0.009)***	0.008 *(0.005)*	- 0.016 *(0.004)***	- 0.014 *(0.004)***
Client Status	0.221 *(0.079)***	0.461 *(0.194)***	0.170 *(0.088)***	0.242 *(0.080)***	0.315 *(0.078) ****
Amount of Previous Loan	0.000 *(0.000)***	-0.000 *(0.000)*	0.000 *(0.000)***	0.000 *(0.000) ****	0.000 *(0.000)***
Sex of Client	- 0.181 *(0.066)***	0.249 *(0.183)*	- 0.235 *(0.073)***	- 0.280 *(0.073)***	- 0.180 *(0.067)***
Poverty Score	0.525 (0.035)***	0.707 *(0.168)***	0.504 *(0.064)***	-	0.530 (0.036)***
Number of Savings Account	0.139 *(0.074)***	0.137 *(0.158)*	0.151 *(0.076)***	0.204 *(0.077)****	0.146 *(0.076)**
Source of funds	0.361 *(0.091)****	0.428 *(0.252)***	0.390 (0.105)****	0.071 *(0.090)*	0.136 *(0.086)*
Household size	0.032 *(0.014)***	0.106 *(0.025)****	0.011 *(0.017)*	0.010 *(0.016)*	0.029 *(0.015)**
Location	1.588 *(0.212)****	Dropped	1.534 *(0.213) ****	1.617 *(0.218)****	1.624 *(0.205) ****
Poor Dummy	-	-	-	- 1.055 (0.099)***	-
Interaction term (Pov. Sc. * Int. Rate)	0.024 *(0.004) ****	-	-	-	-
Constant	13.097 *(0.124)****	14.023 *(0.476)****	12.860 *(0.236)****	14.071 *(0.185)****	13.581 *(0.170)****
R-Squared	**0.50**	**0.52**	**0.34**	**0.42**	**0.48**
Number of Obs.	**698**	**120**	**578**	**698**	**698**
Ramsey's Specification Test	**F = 4.58** **0.000**	**F = 2.41** **0.07**	**F = 7.23** **0.000**	**F = 1.89** **0.13**	**F = 11.21** **(0.000)**
Chow Test	**15.26 (0.000)**				

**** Significant at one percent; ** Significant at five percent * Significant at ten percent*

Table 6
Coefficient of Key Covariates and Interaction at Varied Statistic

Key Covariates	**Coefficients at Varied Statistic** *[standard errors in parenthesis]*			
	Mean	20^{th} Percentile	50^{th} Percentile	75^{th} Percentile
Interest Rate	- 0.002 (0.005)	- 0.024 (0.004)***	0.004 (0.006)	0.014 (0.007)**
Poverty	- 0.525 (0.035)***	- 0.169 (0.135)	- 0.169 (0.136)	0.169 (0.136)
Interaction	- 0.024(0.004)***	0.021 (0.004)***	- 0.021 (0.004)***	- 0.021 (0.004)***

Table 7
Second Stage Estimations

Dependent Variable: *Amount of Current Loan Take-up*	***Coefficients & Robust Standard Errors***				
	(1)	**(2)**	**(3)**	**(4a)**	**(4b)**
Explanatory Variables	**Least Squares**	**Instrumental Variable**	**Hausman**	**Heckman 1.**	**Heckman 2.**
Interest rate	-0.014 *(0.004)***	-0.074 *(0.010)***	- 0.060	- 0.016 *(0.005)***	- 0.013 *(0.005)***
Client Status	0.314 *(0.078)***	0.206 *(0.088)***	0.009	0.044 *(0.124)*	- 0.014 *(0.163)*
Number of Savings Account	0.146 *(0.076)***	0.205 *(0.066)***	0.059	0.171 *(0.59)***	0.139 *(0.58)***
Amount of Previous Loan	0.000 *(0.000)***	-0.000 *(0.000)***	0.000	0.000 *(0.000)***	0.000 *(0.000)***
Poverty Score	0.530 (0.036)***	0.499 *(0.043)***	- 0.031	0.526 *(0.038)***	0.537 *(0.039)***
Location	1.624 *(0.205)***	1.540 *(0.165)***	- 0.083	1.534 *(0.150)***	1.692 *(0.150)***
Source of Funds	0.136 *(0.086)*	0.555 *(0.015)***	0.419	0.235 *(0.105)***	0.019 *(0.110)*
Household size	0.029 *(0.014)***	0.031 *(0.024)***	0.002	0.027 *(0.014)***	0.030 *(0.014)***
Sex of Client	-0.1880 *(0.067)***	- 0.259 *(0.076)***	-0.079	- 0.297 *(0.079)***	- 0.268 *(0.078)***
Constant	13.581 *(0.170)***	15.252 *(0.319)***	-	13.867 *(0.202)***	14.047 *(0.270)***
R-Squared	**0.48**	**0.34**			
Number of Obs.	**698**	**698**		**Censored - 850 Uncensored - 698**	**Censored - 1952 Uncensored - 698**
Operational Self Sufficiency [Instrument]	Correlation between Operational Self Sufficiency and Interest Rate - - - - **0.40**				
Hausman Test	**Chi-Square 40.58 (0.00)**				
Self Employed [Exclusion Variable]	0.002 *(0.096)*			-	-
Heckman - Sigma				**- 6.49 (0.000)**	**- 5.74 (0.000)**
Heckman - Rho				**- 2.68 (0.007)**	**- 2.20 (0.028)**
Heckman – Test of Independence				**5.95 (0.014)**	**3.18 (0.074)**

**** Significant at one percent; ** Significant at five percent * Significant at ten percent*